

## EX. B

IN THE UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF TEXAS (MARSHALL DIVISION)

**CONVOLVE, INC.**

Plaintiff

v.

**Civil Action No. 2:08-CV-244-CE**

**DELL INC., WESTERN DIGITAL  
CORPORATION, HITACHI GLOBAL  
STORAGE TECHNOLOGIES, INC., and  
HITACHI LTD.,**

Defendants.

**Rebuttal Expert Report of Dr. Val DiEuliis**

**February 21, 2011**

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## 8. Overview of the Evolution of Hard Disk Drive Architecture

In the early 1980s, the early days of “small” hard disk drives, known as Winchester drives, when disks were 8 inch in diameter or later when the 5-1/4 inch disk became a standard, disk drives were associated with an “external controller.” An external controller is a printed circuit board that physically plugs into the backplane of the computer system, and is physically separate from the disk drive product. These controllers communicate directly with the processor of the computer system and are connected to the disk drive through a cable. A disk drive associated with an external controller consists of the Head-Disk-Assembly (the HDA<sup>3</sup>) with limited electronics directly attached to it. The external controller and the computer system’s processor control much of the disk drive’s detailed operations.

In the mid-1980s, the IDE (Integrated Drive Electronics) interface was developed which placed the electronics that control the operation of the disk drive on a printed circuit board that was directly attached to the HDA. The communication between the computer system and the disk drive was provided through the newly developed interface—the IDE, a precursor of the present day ATA interface—that consisted of a cable and connectors plus hardware and firmware. The term integrated controller refers to the architecture introduced by the IDE: the controller electronics are integrated with the disk drive, that is, the printed circuit board that provides the controller’s functions is attached directly to the HDA and is delivered with the HDA when a customer purchases such a disk drive<sup>4</sup>.

This evolution of the placement of the disk drive’s controller was driven by computer system manufacturers and disk drive manufacturers as an approach to improve the performance and cost for the computer systems and the hard disk drives. This evolution was not an arbitrary design choice. The development of larger, more complex, custom integrated circuits which perform almost all of the functions needed to operate and interface a hard disk drive reduced the cost of the disk drive system by eliminating the external printed circuit board (viz., the external controller), and replacing its functions by electronics

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<sup>3</sup> The HDA consists of the magnetic disk(s), head(s), actuator arm, VCM (or stepper motor), and spindle motor. These components are enclosed in a sealed case to maintain cleanliness. The HDA is the essence of the disk drive, and for purposes of this litigation, based on the Court’s Markman Order, is the data storage device in the claims of the '473 Patent.

<sup>4</sup> Even with an “integrated controller,” as that phrase is used in the disk drive industry, the controller is external to the HDA to which it is attached and sold.

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Finally, Dr. Buckman repeats the summary paragraphs from his argument regarding claims 7 and 10, in which he describes his theory of a POSITA deciding to remove the controllers attached to the HDA in Ray's and Honda's disk drives, and substitute external controllers instead. See ¶¶ 155-156 and ¶¶ 372-373 and compare with ¶¶ 300-301 and ¶¶ 512-513. My response from claims 7 and 10 applies here. Overall, neither claim 9 nor claim 15 is covered or rendered obvious by the Ray Thesis combined with Honda, and Dr. Buckman has failed to demonstrate otherwise.

Respectfully submitted on February 21, 2011, by Dr. Val DiEuliis

*Val DiEuliis* 2-21-11